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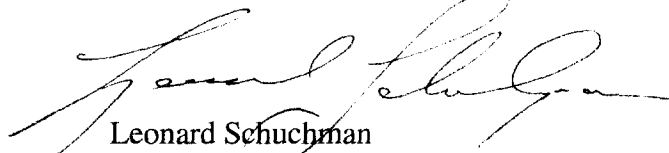
Virginia Facility
1761 Business Center Drive
Reston, VA 22090
Phone: 703/438/8000
Fax: 703/438/8112

January 9, 1995

William F. Caton, Acting Secretary
Office of the Secretary,
Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

Dear Mr. Caton:

Stanford Telecommunications, Inc., is submitting the attached comments in response to FCC Docket No. 94-102 / RM-8143: "In The Matter Of Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems." The comments describe a solution to the need for portable wireless devices to measure their position, and to relay that position to the Mobile Telephone Switching Office (MTSO) and the appropriate Public Safety Answering Point (PSAP).


Leonard Schuchman
President of the
Systems Integration Group

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List ABCDE

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Corporate Headquarters
1721 Crossman Avenue
Sunnyvale, CA 94089-1112
Phone: 408/734/2018

Fort Monmouth Facility
135 Hope Road, Victoria Park
Jatontown, NJ 07724
Phone: 908/542/2290

Seabrook Facility
2501 Forbes Boulevard
Annapolis, MD 20706
Phone: 410/463/8900

Annapolis Facility
41 National Business Plaza
Suite 208
Annapolis Junction, MD 20701-1026
Phone: 410/472/4908

Washington, D.C. Facility
400 Virginia Ave., S.W.
Suite 300, M/W/DC, V41
Washington, D.C. 20024
Phone: 202/696/5304

Massachusetts Facility
150 F. New Boston Street
Woburn, MA 01801
Phone: 617/945/7020

Colorado Facility
5009 Centennial Boulevard
Colorado Springs, CO 80919
Phone: 719/594/4475

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911 and NAVCELL

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To satisfy the 911 position location requirement Stanford Telecom has designed a navigation system "NAVCELL" (patents pending) which will work with FDMA (AMPS), TDMA and CDMA cellular communications systems and within the same bandwidth of operation.

NAVCELL is a system which transmits a spread spectrum ranging signal from each cellular base station site. The NAVCELL receiver in the cellular phone computes its position, in a manner similar to GPS, using the received ranging signal from the nearest cell base station site, and the ranging signals from adjacent cell sites (up to six). The difference between NAVCELL and GPS is that NAVCELL transmissions are from fixed locations, rather than moving satellites, so as to make the position computation much simpler. More importantly, NAVCELL will provide accurate position, better than the 911 requirement, inside and outside of buildings, everywhere that a cell matrix structure exists for communications.

In order to transmit within a cellular communication band there are three key concerns that have to be addressed: 1) the navigation signal cannot interfere with the communications signals; 2) the communication signals do not interfere with the navigation signals; and 3) the navigation signals do not interfere with themselves. Because the ranging signals are spread spectrum signals, their requirements for power per unit of spectrum are well below communication requirements, thereby causing no problem to the coexisting communication signals. The NAVCELL receiver design eliminates the concern of having strong communication signals, transmitted from a nearby cell site, interfering with weaker ranging signals transmitted from adjacent cellular sites. Finally, the NAVCELL design time gates the ranging signals in a non-interfering manner so that each cell base station site transmits its ranging signal for a fraction of a second, every second, with the result that the navigation signals do not interfere with each other.

NAVCELL utilizes a fixed bandwidth in each cell that is approximately 2 MHz wide. The specific portion of the cellular band utilized is the same for each cell, and the ranging signal spread spectrum code is also the same for each cell, thereby simplifying the design of the NAVCELL receiver.

Each communication cell base station site transmits the relevant, adjacent cellular base station positions together with their time slot allocations and other NAVCELL information; the number of cell sites simultaneously addressed will typically be seven. This information is transmitted on both the base station communication control channel, and as a message on the ranging signal. The mobile station position for 911 is transmitted from the cellular portable phone to the MTSO via the control channel, is then remodulated onto the PSTN network via a modem, and finally transmitted to the emergency service center of interest. Thus, the existing cellular control infrastructure is utilized to transmit NAVCELL data, causing minimal modification to the cellular infrastructure while reducing the cost to the cellular phone to little more than a chip set.

Implementation of the NAVCELL infrastructure requires each base station site to include a NAVCELL spread-spectrum signal transmitter, and a GPS receiver for time synchronization. The NAVCELL transmitter power is very low -- less than 1/100th of the base station transmitter power.

It is clear that once the NAVCELL infrastructure is in place, all other cellular position-dependent services can be provided, although many will require cellular communication channels to transmit position and position updates to the service provider.

NAVCELL is designed to provide accurate two dimensional position wherever there is a cellular infrastructure. The requirement for knowing the floor of a building is an enhancement to NAVCELL and is satisfied by using RF sign posts as required.

An RF sign post is a tiny transmitter located at the suite entrance of a floor which

transmits street address, floor number and suite number to a micro-chip integrated into the NAVCELL receiver. The RF sign post transmitter, with a range of 25 feet, is extremely low cost, and the additional cost to the portable user is almost negligible.

Stanford Telecom (STel) has been involved with designing navigation systems for more than twenty years. Dr. Jim Spilker, the president of Stanford Telecom was one of the original designers of GPS, and STel has been building GPS equipments for twenty years. We have also designed navigation systems using the NASA Tracking and Data Relay Satellite (TDRS) for spacecraft navigation and tracking. STel is supporting the FAA in developing the Wide Area Augmentation System (WAAS) which will allow aircraft around the world to navigate safely via GPS, and we have designed and developed GPS pseudolites which will allow aircraft to land safely utilizing the augmented GPS system. Finally, STel is heavily involved in the IVHS program and has provided a turnkey system to NYNEX for its project Northstar, which transmits differential GPS, via the cellular system, through a STel patented modem and displays the tracked GPS position on a service provider's display. The services β tested by NYNEX through Project Northstar include auto and personnel road side services, security tracking services and routing services.